

Response

Applicant: Nicola Da Dalt

Serial No.: 10/541,049

Filed: February 13, 2006

Docket No. 1435.128.101/12928US

Title: DEVICE AND METHOD FOR FREQUENCY SYNTHESIS

REMARKS

The following remarks are made in response to the Non-Final Office Action mailed October 13, 2009. Claims 17-19, 22, 23, 25, and 29-31 were rejected. With this Response, no claims have been amended. Claims 17-19, 22, 23, 25, and 29-31 remain pending in the application and are presented for reconsideration and allowance.

Claim Rejections under 35 U.S.C. § 103

The Examiner rejected claims 17, 19, 22, 25, 29, and 31 under 35 U.S.C. § 103(a) as being unpatentable over the Duff GB Patent No. 2 002 157.

The Examiner rejected claims 18 and 30 under 35 U.S.C. § 103(a) as being unpatentable over the Duff GB Patent No. 2 002 157 in view of the Kamas et al. U.S. Patent No. 6,429,799.

The Examiner rejected claims 17 and 23 under 35 U.S.C. § 103(a) as being unpatentable over the Hirotsu EP Patent No. 0 430 493 in view of the Dietl et al. U.S. Patent No. 6,556,088.

One criteria that must be satisfied to establish a *prima facie* case of obviousness is the reference or combined references must teach or suggest all of the claim limitations. *In re Royka*, 490 F.2d 981 [180 USPQ 580] (C.C.P.A. 1974). However, “[a] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1731 [82 USPQ2d 1385, 1389] (2007). In making an obviousness determination over a combination of prior art references, it is “important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *Id.* at 1738 [1396].

In order to facilitate review of the determination of whether there was an apparent reason to combine known elements in the fashion claimed by the patent at issue, the “analysis should be made explicit.” *Id.* at 1738 [1396]. “[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 [78 USPQ2d 1329] (Fed. Cir. 2006) (cited with approval in *KSR*, 127 S. Ct. at 1738 [82 USPQ2d at 1396])

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The test for obviousness under § 103 must take into consideration the invention as a whole; that is, one must consider the particular problem solved by the combination of elements that define the invention. *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143 [227 USPQ 543, 551] (Fed. Cir. 1985) (emphasis added). A prior patent cited as a § 103 reference must be considered in its entirety, “i.e. as a whole, including portions that lead away from the invention.” *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1568 [1 USPQ2d 1593, 1597] (Fed. Cir. 1987), *cert. denied*, 481 U.S. 1052 (1987). That is, the Examiner must recognize and consider not only the similarities, but also the critical differences between the claimed invention and the prior art as one of the factual inquiries pertinent to any obviousness inquiry under 35 U.S.C. § 103. *In re Bond*, 910 F.2d 831, 834 [15 USPQ2d 1566, 1568] (Fed. Cir. 1990) (emphasis added).

Furthermore, the Examiner must avoid hindsight. *Id.* “A fact finder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, 127 S. Ct. at 1739 [82 USPQ2d at 1397] (citing to *Graham v. John Deere*, 383 U.S. 1 [148 USPQ 459] (1966) in warning against a temptation to read into the prior art the teachings of the invention at issue and instructing courts to guard against slipping into the use of hindsight).

The Examiner has not established a *prima facie* case of obviousness with regard to independent claims 17 and 29.

Independent claim 17 recites that an average value of the generated output frequencies over a certain time period is the desired frequency plus or minus a relative frequency error, wherein the control device is configured to drive the oscillator such that the least two generated output frequencies are alternated at a selected average switching frequency that is less than the at least two possible output frequencies, and a frequency divider is connected to the output of the oscillator and configured to reduce the relative frequency error generated at the selected average switching frequency, wherein the selected average switching frequency is selected to be smaller than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider.

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Independent claim 29 recites that the average value of the at least two generated output frequencies over a certain time period is the desired frequency plus or minus a relative frequency error, and the at least two generated output frequencies are alternated at a selected average switching frequency that is less than the at least two different output frequencies, and the frequency of the output signal generated by the oscillator is divided with a frequency divider to reduce the relative frequency error generated at the selected average switching frequency, wherein the selected average switching frequency is selected to be smaller than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider.

The Examiner admits that the Duff GB Patent does not teach a control device configured to drive the oscillator such that the at least two generated output frequencies are alternated at a **selected average switching frequency selected by the control device to be smaller than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider** as recited independent claims 17 or alternating the at least two generated output frequencies at a selected average switching frequency selected to be smaller than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider as recited in independent claim 29.

The Examiner also admits that the Hirotsu EP Patent does not teach the limitations of independent claim 17 of a frequency divider connected to the output of the oscillator and configured to reduce the relative frequency error generated at the selected average switching frequency, wherein **the selected average switching frequency is selected to be smaller than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider**. The Examiner cites so the Dietl et al. Patent, which, however, only discloses a voltage controlled oscillator (VCO) 16 having an output provided to a frequency divider 18 in a phase-locked loop (see e.g., Figures 1 and 2). As such, the combination of the Hirotsu EP Patent and the Dietl et al. Patent does not teach or suggest a control device configured to drive the oscillator such that the at least two generated output frequencies are alternated at a **selected average switching frequency selected by the control device to be smaller than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider** as recited independent claims 17

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These limitations define that **the selected average switching frequency is selected by the control device to obtain a desired frequency error, which would not be obtained with this switching frequency without the frequency divider**. In other words, in contrast to the Duff GB Patent or the combination of the Hirotsu EP Patent and the Dietl et al. Patent, a time averaging property of the frequency divider is consciously employed by the control device defined in independent claims 17 and 29 to permit selection of a smaller switching speed than would otherwise be possible while still obtaining acceptable results.

Even though the Examiner admits that the Duff GB Patent does not expressly teach wherein the control device is configured to drive oscillators such that the at least two generated output frequencies are alternated at a selected average switching frequency that is less than the at least two possible output frequencies and is smaller than a switching frequency necessary to obtain a desired relative frequency error, the Examiner states that such a selection would be found through routine experimentation.

Applicant, however, respectfully submits that one skilled in the art would perform any routine experimentation only for parameter ranges where the person skilled in the art expects at least some chance of success. This is definitely not the situation for the ranges of the switching frequency defined in independent claims 17 and 29 that define that the selected average switching frequency is selected by the control device to obtain a desired frequency error, which would not be obtained with the switching frequency without the frequency divider. Without being aware of the averaging properties of the frequency divider (which, while an intrinsic property, has not been recognized in the Duff GB Patent or the Hirotsu EP Patent or the Dietl et al. Patent or any of the other prior art cited by the Examiner), a person skilled in the art would expect huge errors or unsatisfactory averaging of the frequencies to occur in the ranges for the switching frequency defined in the independent claims.

For example, with regard to the limitations of independent claim 17, generally when the selected average switching frequency is less than at least two possible output frequencies, this means that the two output frequencies before the switching complete one or more periods of the whole oscillation. This usually would be expected to lead to a signal which has a changing frequency, but not to a signal which has a desired synthesized output frequency with a desired

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frequency error which is in between the two output frequencies. As such, in routine experimentation, a person skilled in the art would not attempt a frequency range defined in independent claims 17 and 29.

In view of the above, only after the inventor of the Present Invention recognized the intrinsic averaging effect could the inventor reduce the switching frequencies as defined in independent claims 17 and 29 with a reasonable expectation of success. As such, the Examiner's reasoning used in the present Office Action improperly uses hindsight in attempting to establish a *prima facie* case of obviousness against independent claims 17 and 29.

Independent claims 17 and 29 respectively define a device and a method that are not taught or suggested by the Duff GB Patent or by the combination of the Hiroto EP Patent and the Dietl et al. Patent that provide a smaller (i.e., slower) switching frequency of switching between the at least two output frequencies while still yielding a good approximation of the desired output frequency by reducing the relative frequency error generated at the selected average switching frequency.

One example embodiment having the limitations of independent claims 17 and 29 is described at page 8 of the clean version of the substitute specification, which explains the employment of the frequency dividers as illustrated in Figures 8A, 8B, and 8C of the Present Specification. Figure 8A illustrates the time characteristic of the voltage of the control signal and the time characteristic of the frequency of the voltage of the signal f_{OUT} generated by the digitally controlled oscillator, and Figures 8B and 8C respectfully illustrate the time characteristic of the frequency and the voltage of the signal after the first and second frequency divider respectively to illustrate the effect of the frequency dividers which cause the averaging period to be extended. The example embodiment described at page 8 of the Present Specification, specifically states that the relative frequency error at the output of the digitally controlled oscillator is 3.7% in the illustrated example and at the output of the second frequency divider, the relative frequency error is only 0.22%.

The limitations of independent claim 17 (and similar limitations of independent claim 29) define that the **frequency divider is configured to reduce the relative frequency error generated at the selected average switching frequency**, wherein **the selected average**

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switching frequency is selected by the control device to be smaller (i.e, slower) than a switching frequency necessary to obtain a desired relative frequency error without the frequency divider. These limitations of independent claims 17 and 29 effectively exploit the averaging effects of the frequency divider to achieve even slower switching frequencies, and slower switching frequencies are desirable as slower frequencies generally are easier to handle and control and can be realized with less expensive and/or more precise circuitry. Furthermore, without recognizing the time averaging properties of a frequency divider, a person skilled in the art would select a considerably higher switching frequency than can be used with the invention defined in independent claims 17 and 29 which specifically exploits the averaging effects of the frequency divider.

Furthermore, dependent claims 18-19, 22-23, and 25 further define patentably distinct independent claim 17. Dependent claims 30-31 further define patentably distinct independent claim 29. Therefore, these dependent claims are also believed to be allowable.

Therefore, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 103 rejections to the claims, and requests allowance of claims 17-19, 22, 23, 25, and 29-31.

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CONCLUSION

In view of the above, Applicant respectfully submits that pending claims 17-19, 22, 23, 25, and 29-31 are in form for allowance and are not taught or suggested by the cited references. Therefore, reconsideration and withdrawal of the rejections and allowance of claims 17-19, 22, 23, 25, and 29-31 are respectfully requested.

No fees are required under 37 C.F.R. 1.16(h)(i). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 50-0471.

The Examiner is invited to contact the Applicant's representative at the below-listed telephone numbers to facilitate prosecution of this application.

Any inquiry regarding this Amendment and Response should be directed to Patrick G. Billig at Telephone No. (612) 573-2003, Facsimile No. (612) 573-2005. In addition, all correspondence should continue to be directed to the following address:

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Respectfully submitted,

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